PATENT COOPERATION TREATY

PCT

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY
(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and Rule 70)

Applicant's or agent's file reference	FOR FURTHER ACTION See Form PCT/IPEA/416	
P06448PC00		
International application No.	International filing date *(day/month/year)*	Priority date *(day/month/year)*
PCT/SE2004/000478	30-03-2004	22-12-2003
International Patent Classification (IPC) or national classification and IPC		
See Supplemental Box		
Applicant		
Telefonaktiebolaget LM Ericsson (publ) et al		

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 5 sheets, including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising:

   a. ☒ *(sent to the applicant and to the International Bureau)* a total of 9 sheets, as follows:

      ☒ sheets of the description, claims and/or drawings which have been amended and are the basis of this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).

      ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No. I and the Supplemental Box.

   b. ☐ *(sent to the International Bureau only)* a total of (indicate type and number of electronic carrier(s))

      _____, containing a sequence listing and/or tables related thereto, in electronic form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:

☒	Box No. I	Basis of the report
☐	Box No. II	Priority
☐	Box No. III	Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
☐	Box No. IV	Lack of unity of invention
☒	Box No. V	Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
☐	Box No. VI	Certain documents cited
☒	Box No. VII	Certain defects in the international application
☐	Box No. VIII	Certain observations on the international application

Date of submission of the demand	Date of completion of this report
08-08-2005	01-12-2005
Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. +46 8 667 72 88	Authorized officer Stefan Dufva/MN Telephone No. +46 8 782 25 00

Supplemental Box

In case **the space in any of the preceding boxes is not sufficient.**
Continuation of: Cover sheet

H04Q 7/38 (2006.01)

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/SE2004/000478

Box No. I Basis of the report

1. With regard to the **language**, this report is based on:

☐ the international application in the language in which it was filed

☐ a translation of the international application into _____ ,
which is the language of a translation furnished for the purposes of:

☐ international search (Rules 12.3(a) and 23.1(b))

☐ publication of the international application (Rule 12.4(a))

☐ international preliminary examination (Rules 55.2(a) and/or 55.3(a))

2. With regard to the **elements** of the international application, this report is based on *(replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report):*

☐ the international application as originally filed/furnished

☒ the description:

pages 1-67 as originally filed/furnished

pages* _____ received by this Authority on _____

pages* _____ received by this Authority on _____

☒ the claims:

pages _____ as originally filed/furnished

pages* _____ as amended (together with any statement) under Article 19

pages* 68-76 received by this Authority on 08-08-2005

pages* _____ received by this Authority on _____

☒ the drawings:

pages 1-18 as originally filed/furnished

pages* _____ received by this Authority on _____

pages* _____ received by this Authority on _____

☐ a sequence listing and/or any related table(s) – see Supplemental Box Relating to Sequence Listing.

3. ☐ The amendments have resulted in the cancellation of:

☐ the description, pages _____

☐ the claims, Nos. _____

☐ the drawings, sheets/figs _____

☐ the sequence listing *(specify)*: _____

☐ any table(s) related to the sequence listing *(specify)*: _____

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).

☐ the description, pages _____

☐ the claims, Nos. _____

☐ the drawings, sheets/figs _____

☐ the sequence listing *(specify)*: _____

☐ any table(s) related to the sequence listing *(specify)*: _____

* *If item 4 applies, some or all of those sheets may be marked "superseded."*

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/SE2004/000478

Box No. V **Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

1. Statement

Novelty (N)	Claims	1-47	YES
	Claims		NO
Inventive step (IS)	Claims	1-47	YES
	Claims		NO
Industrial applicability (IA)	Claims	1-47	YES
	Claims		NO

2. Citations and explanations (Rule 70.7)

The claimed invention

The present invention relates to macro diversity in a mobile communications system. In prior art the splitting and combining is done in the Radio Network Controller (RNC). This results in that the split downlink flows and the uncombined uplink flows of user data are transported all the way between the RNC and the Node B. This problem is solved by the macro diversity functionality being distributed to the Node B.

The claims have been amended.

Reference is made to the following documents:

D1: WO03096733 A1
D2: WO03096632 A1
D3: WO03049482 A1
D4: WO03017686 A2

D1 describes an IP radio access network with nodes (A-F). One node (A) corresponds to a radio access network gateway (RNGW), i.e. a gateway to the core network, (page 7 lines 6-8). The remaining nodes are base stations. Every node can be a macro diversity combining (MDC) point, (abstract). All the nodes have a view over the network topology, (page 9 lines 9-15).

A centralised resource managing device or the base stations can perform a selection of an MDC point (claims 22-26). The selection of the MDC point is based on the total hop of the MDC legs and path between the RNGW and the MDC point, (page 7 lines 31-36), and the load on the links between the nodes, (figure 7, page 12 line 28-page 13 line 4).

.../...

Box No. VII Certain defects in the international application

The following defects in the form or contents of the international application have been noted:

In the description on page 5 line 22, it is stated that the arrangement is referred to in claims 25, 26 and 27. However, in the claims, claim 25 refers to a method.

Tables 1-8 in the description are not complete. The columns to the right are partly missing.

D2 relates to distributing network parameters, which are used in an MDC point selection procedure, (claims 1-3). A spanning tree is used to distribute the parameters, (page 10 lines 6-20).

D3 reveals that the combining and splitting functionality can be located in an RNC or in a Node B, (page 5 lines 19-21). The combining-splitting point can be an MDC point.

D4 also describes that the macro diversity combiner can be in an IP BTS, (page 2 lines 6-12).

Reasoned statement

D1 is considered to represent closest prior art. However, D1 as well as D2-D4 fail to disclose that more than one DHO node mail be selected irrespective of the number of legs in the macro diversity configuration.

Further, the cited references fail to disclose that the delay requirement is taken into account. According to the claimed invention, the resulting path delay must not exceed a maximum allowed path delay for any of the flows of the resulting macro diversity tree.

Consequently, the claimed invention as in claims 1-47 is novel, considered to involve an inventive step and has industrial applicability.

PCT / SE 2004 / 0 0 0 4 7 8

0 8 -08- 2005

CLAIMS

1. A method for selecting one or more Diversity Handover, DHO, nodes, such as a Node B or a Radio Network Controller, RNC, executing a macro diversity functionality, in a mobile telecommunication network wherein the macro diversity functionality is distributed to one or a plurality of DHO nodes such as a RNC and its connected Node B(s) in said network, the method is **characterised by** the steps of:

a.-obtaining topology information comprising a hop-by-hop route from the RNC to each of its connected Node Bs and at least one metric for each hop in the route, and

b.-using an algorithm for selecting one or more DHO node(s), whereby the algorithm comprises the steps of:

-forming a macro diversity tree of the routes by means of the obtained topology information, and

-selecting the Node B(s) and/or the RNC and/or other DHO enabled node(s), that result in the best accumulated metric for all potential data flows between the RNC and its connected Node B(s) in the macro diversity tree of routes, as the DHO node(s),

c. –checking that a maximum allowed delay is not exceeded for a data path for each of the selected one or more DHO node(s) by using the delay metric from the topology information, and

if the maximum allowed delay is exceeded,

-performing a delay reduction procedure until the maximum allowed delay is not exceeded, wherein the delay reduction procedure comprises the step of:

-removing already selected macro diversity enabled nodes.

PCT / SE 2004 / 0 0 0 4 7 8
0 8 -08- 2005

2. The method according to claim 1, wherein the topology information further comprises for each non-DHO enabled node in the topology information an indication of the closest DHO enabled node.

3. The method according to any of claims 1-2, wherein the forming-step comprises the further steps of:

-identifying branching nodes in said tree of routes, and

-identifying the relative interconnections of said branching nodes and the connections to Node Bs and the RNC of said branching nodes.

4. The method according to any of claims 1-3, wherein the at least one metric comprises a delay metric and a generic cost metric and that the step of selecting the DHO Node(s) with the best accumulated metric comprises the steps of:

-selecting the DHO node(s) resulting in the smallest accumulated cost for all potential data flows between the RNC and its connected Node B(s) in the macro diversity tree, as the DHO node(s),

if the accumulated cost is substantially the same for two potential DHO nodes,

selecting as the DHO node the potential DHO node that results in the smallest accumulated delay metric for all potential data flows between the RNC and its connected Node B(s) in the macro diversity tree.

5. The method according to any of claims 1-3, wherein the at least one metric comprises a generic cost.

6. The method according to any of claims 1-3, wherein the at least one metric comprises a delay metric.

7. The method according to any of claims 1-6, wherein the method comprises the further step of:

-combining the delay metric with node synchronisation measurement in order to determine if the maximum delay is exceeded.

8. The method according to any of methods 1-2, wherein the at least one metric comprises a delay metric and a generic cost metric and the

PCT / SE 2004 / 0 0 0 4 7 8
0 8 -08- 2005

step of selecting the DHO Node(s) with the best accumulated metric comprises the further steps of:

- tentatively selecting a DHO node,
- checking whether the delay of a potential data flow between the RNC and one of its connected Node Bs would exceed a maximum allowed delay if it were to traverse the tentatively selected DHO node, and

selecting the tentatively selected DHO node as a DHO node for said potential data flow if said maximum allowed delay is not exceeded.

9. The method according to any of claims 1-8, wherein the topology information is obtained through manual or semi-automatic management operations in the RNC.

10. The method according to any of claims 1-8, wherein the topology information is obtained via a link state routing protocol used in the transport network.

11. The method according to any of claims 1-8, wherein the topology information is obtained by using a traceroute mechanism that allows the RNC to discover the hop-by-hop route to each Node B.

12. The method according to any of claims 1-8, wherein the topology information is obtained by retrieving the topology information from a RNC in the network.

13. The method according to any of the previous claims, wherein the method comprises the further steps of:

-preparing a DHO related signalling message to be conveyed to a DHO tree node that is a node that is or is planned to be a part of a macro diversity tree,
-including in the signaling message one or more transport layer addresses and one or more transport bearer reference parameters in order to direct one or more inter-DHO tree node data flows of the macro diversity tree, and
-sending said signaling message to said DHO tree node in order to provide DHO related instructions to said DHO tree node.

14. The method according to claim 13, wherein the including-step comprises the further step of:

-replacing the transport layer address and transport bearer reference parameter of an RNC by the transport layer address and transport bearer reference parameter of a DHO tree node that is hierarchically higher than said DHO tree node in a regular signaling message sent to said DHO tree node in order to direct a data flow between said DHO tree node and said higher DHO tree node in the DHO tree node hierarchy.

15. The method according to any of claims 13-14, wherein the including-step comprises the further step of:

-including one or more transport layer addresses and one or more transport bearer reference parameters of one or more DHO tree node(s) that are hierarchically lower than said DHO tree node in a signalling message sent to said DHO tree node in order to direct one or more data flows between said DHO tree node and said one or more lower DHO tree node(s) in the DHO node hierarchy.

16. The method according to any of the claims 13-15, wherein said transport layer addresses are IP addresses and said transport bearer reference parameters are UDP ports.

17. The method according to any of the claims 13-15, wherein said transport layer addresses are ATM addresses and said transport bearer reference parameters are SUGR parameters.

18. The method according to any of claims 13-17, further comprising the step of:

-including in the signaling message Quality of Service (QoS) indications for the data flow(s) to be directed.

19. The method according to any of claims 13-18, further comprising the step of:

-including timing parameters in the signaling message to be used in the uplink combining procedure in the DHO tree node receiving said signaling message.

20. The method according to any of claims 13-19, further comprising the step of:

-including a time indication in the signaling message indicating when the DHO related instructions in the signalling message are to be effectuated in the DHO tree node receiving said signaling message.

21. The method according to claim 20, wherein said time indication is a connection frame number, CFN, pertaining to a Dedicated Channel Frame Protocol, DCH FP, in a UMTS Terrestrial Radio Access Network, UTRAN.

22. The method according to any of claims 13-21, wherein said signaling message is sent from a RNC.

23. The method according to claim 22, wherein said signaling message is a Node B Application Part, NBAP, message.

24. A computer program product directly loadable into the internal memory of a computer within a Radio Network Controller and/or a Node B in a mobile telecommunication network, comprising the software code portions for performing the steps of any of claims 1-23.

25. A computer program product stored on a computer usable medium, comprising a readable program for causing a computer, within a Radio Network Controller and/or a Node B in a mobile telecommunication network, to control an execution of the steps of any of the claims 1-23.

26. A Radio Network Controller, RNC, adapted for selecting a DHO node, e.g. a Node B or a RNC executing a macro diversity functionality in a mobile telecommunication system, wherein the macro diversity functionality is distributed to one or a plurality of DHO nodes such as a Radio Network Controller, RNC, and its connected Node Bs in said network, the RNC is **characterised in** that it comprises:

means for obtaining topology information comprising a hop-by-hop route from the RNC to each of its connected Node Bs and at least one metric for each hop in the route, and

means for using an algorithm for selecting one or more DHO node(s), whereby said means comprises further:

means for forming a macro diversity tree of the routes by means of the obtained topology information,

means for selecting the Node B(s) and/or the RNC and/or other DHO enabled node(s), that result in the best accumulated metric for all potential data flows between the RNC and its connected Node B(s) in the macro diversity tree of routes, as the DHO node(s), and further means for:

–checking that a maximum allowed delay is not exceeded for a data path for each of the selected one or more DHO node(s) by using the delay metric from the topology information, and

if the maximum allowed delay is exceeded,

-means for performing a delay reduction procedure until the maximum allowed delay is not exceeded, wherein the means for performing a delay reduction procedure comprises means for removing already selected macro diversity enabled nodes.

27. The RNC according to claim 26, wherein the topology information further comprises for each non-DHO enabled node in the topology information an indication of the closest DHO enabled node.

28. The RNC according to any of claims 26-27, wherein the means for forming a macro diversity tree further comprises means for:

-identifying branching nodes in said tree of routes, and means for

-identifying the relative interconnections of said branching nodes and the connections to Node Bs and the RNC of said branching nodes.

29. The RNC according to any of claims 26-28, wherein the at least one metric comprises a delay metric and a generic cost metric and that the means for selecting the DHO Node(s) with the best accumulated metric comprises means for:

-selecting the DHO node(s) resulting in the smallest accumulated cost for all potential data flows between the RNC and its connected Node B(s) in the macro diversity tree, as the DHO node(s),

if the accumulated cost is substantially the same for two potential DHO nodes,

means for selecting as the DHO node the potential DHO node that results in the smallest accumulated delay metric for all potential

PCT / SE 2004 / 0 0 0 4 7 8
0 8 -08- 2005

data flows between the RNC and its connected Node B(s) in the macro diversity tree.

30. The RNC according to any of claims 26-28, wherein the at least one metric comprises a generic cost.

31. The RNC according to any of claims 26-28, wherein the at least one metric comprises a delay metric.

32. The RNC according to claim 31, wherein the RNC comprises the further means for combining the delay metric with node synchronisation measurement in order to determine if the maximum delay is exceeded.

33. The RNC according to any of methods 26-27, wherein the at least one metric comprises a delay metric and a generic cost metric and the means for selecting the DHO Node(s) with the best accumulated metric comprises the further means for

- tentatively selecting a DHO node,
- checking whether the delay of a potential data flow between the RNC and one of its connected Node Bs would exceed a maximum allowed delay if it were to traverse the tentatively selected DHO node, and means for

selecting the tentatively selected DHO node as a DHO node for said potential data flow if said maximum allowed delay is not exceeded.

34. The RNC according to any of claims 26-33, wherein the topology information is obtained through manual or semi-automatic management operations in the RNC.

35. The RNC according to any of claims 26-33, wherein the topology information is obtained via a link state routing protocol used in the transport network.

36. The RNC according to any of claims 26-33, wherein the topology information is obtained by using a traceroute mechanism that allows the RNC to discover the hop-by-hop route to each Node B.

37. The RNC according to any of claims 26-33, wherein the topology information is obtained by retrieving the topology information from a RNC in the network.

38. The RNC according to any of the previous claims 26-37, wherein the RNC comprises the further means for:

-preparing a DHO related signalling message to be conveyed to a DHO tree Node that is a node that is or is planned to be a part of a macro diversity tree.

-including in the signaling message one or more transport layer addresses and one or more transport bearer reference parameters in order to direct one or more inter-DHO tree node data flows of the macro diversity tree, and means for

-sending said signaling message to said DHO tree Node in order to provide DHO related instructions to said DHO tree node.

39. The RNC according to claim 38, wherein the means for including comprises the further means for replacing the transport layer address and transport bearer reference parameter of an RNC by the transport layer address and transport bearer reference parameter of a DHO tree node that is hierarchically higher than said DHO tree node in a regular signaling message sent to said DHO tree node in order to direct a data flow between said DHO tree node and said higher DHO tree node in the DHO tree node hierarchy

40. The RNC according to any of claims 38-39, wherein the means for including comprises the further means for including one or more transport layer addresses and one or more transport bearer reference parameters of one or more DHO tree node(s) that are hierarchically lower than said DHO tree node in a signalling message sent to said DHO tree node in order to direct one or more data flows between said first DHO tree node and said one or more lower DHO tree node(s) in the DHO tree node hierarchy.

41. The RNC according to any of the claims 38-40, wherein said transport layer addresses are IP addresses and said transport bearer reference parameters are UDP ports.

PCT / SE 2004 / 0 0 0 4 7 8
0 8 -08- 2005

42. The RNC according to any of the claims 28-40, wherein said transport layer addresses are ATM addresses and said transport bearer reference parameters are SUGR parameters.

43. The RNC according to any of claims 38-42, further comprises means for-including in the signaling message Quality of Service (QoS) indications for the data flow(s) to be directed.

44. The RNC according to any of claims 38-43, further comprises means for including timing parameters in the signaling message to be used in the uplink combining procedure in the DHO tree node receiving said signaling message.

45. The RNC according to any of claims 38-44, further comprises means for-including a time indication in the signaling message indicating when the DHO related instructions in the signalling message are to be effectuated in the DHO tree node receiving said signaling message.

46. The RNC according to claim 45, wherein said time indication is a connection frame number, CFN, pertaining to a Dedicated Channel Frame Protocol, DCH FP, in a UMTS Terrestrial Radio Access Network, UTRAN.

47. The RNC according to any of claims 38-46, wherein said signaling message is a Node B Application Part, NBAP, message.